

IN THE CLAIMS:

The status of the claims is noted below.

1. (Currently Amended) A timing error detection circuit for detecting a timing error of symbols arranged at a predetermined symbol cycle included in a signal, comprising:

a sampling circuit for sampling said signal at a frequency equal to or more than double of a symbol rate;

an amplitude detection circuit for detecting an amplitude at said sampled position in said signal; and

a detection circuit for detecting a direction and amount of said timing error based on difference of said detected plurality of amplitudes.

2. (Original) A timing error detection circuit as set forth in claim 1, wherein said signal is a phase shift modulated signal.

3. (Original) A timing error detection circuit for detecting a timing error of symbols arranged at a predetermined symbol cycle T included in a signal, comprising:

a sampling circuit for sampling said signal at a frequency equal to four times of a symbol rate;

an amplitude detection circuit for detecting an amplitude at said sampled position in said signal; and

a detection circuit for detecting a direction and amount of said timing error based on the large or small relationship and the difference of said detected amplitude at time " $T/4$ " and the detected amplitude at time " $3T/4$ " when assuming a symbol appears at times " 0 " and " T ".

4. (Original) A timing error detection circuit as set forth in claim 3, wherein said signal is a phase shift modulated signal.

5. (Original) A timing error detection circuit for detecting a timing error of symbols arranged at a predetermined symbol cycle T included in a signal, comprising:

a sampling circuit for sampling at a frequency equal to double of a symbol rate;

an interpolation circuit for generating data at time " $T/4$ " by using sampled data at time " 0 " and " $T/2$ ", and generating data at time " $3T/4$ " by using said sampled data at time " $T/2$ " and data on time " T " when assuming a symbol appears at times " 0 " and " T ";

an amplitude detection circuit for detecting an amplitude of said signal at the position from data at said time " $T/4$ " and time " $3T/4$ "; and

a detection circuit for detecting a direction and amount of said timing error based on the large or small relationship and the difference of the amplitude at said time " $T/4$ " and the amplitude at said time " $3T/4$ ".

6. (Original) A timing error detection circuit as set forth in claim 5, wherein said signal is a phase shift modulated signal.

7. (Currently Amended) A demodulation circuit, comprising:
a symbol timing reproduction circuit for detecting a timing error of symbols arranged at a predetermined symbol cycle included in a signal and reproducing a symbol timing of said signal based on the detected timing error;

a carrier reproduction circuit for performing carrier reproduction of the signal
wherein said symbol timing is reproduced; and

a symbol decode circuit for decoding said symbol included in said carrier
reproduced signal;

and wherein:

said symbol timing reproduction circuit comprises:

a sampling circuit for sampling said signal at a frequency equal to or more than
double of a symbol rate or more;

an amplitude detection circuit for detecting an amplitude at said sampled position
in said signal;

a detection circuit for detecting direction and amount of said timing error based
on difference of said detected plurality of amplitudes; and

an interpolation circuit for reproducing the symbol timing by performing
interpolation processing on said signal based on said detected timing error.

8. (Original) A demodulation circuit as set forth in claim 7, wherein said signal is a
phase shift modulated signal.

9. (Original) A demodulation circuit, comprising:
a symbol timing reproduction circuit for detecting a timing error of symbols
arranged at a predetermined symbol cycle included in a signal and reproducing a symbol timing
of said signal based on the detected timing error;

a carrier reproduction circuit for performing carrier reproduction of the signal wherein said symbol timing is reproduced; and

a symbol decode circuit for decoding said symbol included in said carrier reproduced signal:

and wherein:

said symbol timing reproduction circuit comprises:

a sampling circuit for sampling said signal at a frequency equal to four times of a symbol rate;

an amplitude detection circuit for detecting an amplitude at said sampled position in said signal;

a detection circuit for detecting a direction and amount of said timing error based on sizes and difference of said detected amplitude at time " $T/4$ " and the detected amplitude at time " $3T/4$ " when assuming a symbol appears at times "0" and "T"; and

an interpolation circuit for reproducing the symbol timing by performing interpolation processing on said signal based on said detected timing error.

10. (Original) A demodulation circuit as set forth in claim 9, wherein said signal is a phase shift modulated signal.

11. (Original) A demodulation circuit, comprising:

a symbol timing reproduction circuit for detecting a timing error of symbols arranged at a predetermined symbol cycle included in a signal and reproducing a symbol a symbol timing of said signal based on the detected timing error;

a carrier reproduction circuit for performing carrier reproduction of the signal wherein said symbol timing was reproduced; and

a symbol decode circuit for decoding said symbol included in said carrier reproduced signal;

and wherein:

said symbol timing reproduction circuit comprises:

a sampling circuit for sampling said signal at a frequency equal to double of a symbol rate;

a first interpolation circuit for generating data at time " $T/4$ " by using said sampled data at time " 0 " and " $T/2$ ", and generating data at time " $3T/4$ " by using said sampled data at time " $T/2$ " and data at time " T " when assuming a symbol appears at times " 0 " and " T ";

an amplitude detection circuit for detecting an amplitude of said signal at the position from data on said time " $T/4$ " and data at said time " $3T/4$ ";

a detection circuit for detecting a direction and amount of said timing error based on the large or small relationship and the difference of an amplitude at said time " $T/4$ " and an amplitude at said time " $3T/4$ "; and

a second interpolation circuit for reproducing a symbol timing by performing interpolation processing on said signal based on said detected timing error.

12. (Original) A demodulation circuit as set forth in claim 11, wherein said signal is a phase shift modulated signal.

13. (Currently Amended) A timing error detection method for detecting a timing error of symbols arranged at a predetermined symbol cycle included in a signal, comprising the steps of:

sampling said signal at a frequency equal to or more than double of a symbol rate;

detecting an amplitude at said sampled position in said signal; and

detecting a direction and size of said timing error based on difference of said detected plurality of amplitudes.

14. (Original) A timing error detection method as set forth in claim 13, wherein said signal is a signal subjected to phase shift modulation.

15. (Original) A timing error detection method for detecting a timing error of symbols arranged at a predetermined symbol cycle T included in a signal, including the steps of:

sampling said signal at a frequency of four times a symbol rate;

detecting an amplitude at said sampled position in said signal; and

detecting a direction and size of said timing error based on sizes and difference of said detected amplitude at time " $T/4$ " and the detected amplitude at time " $3T/4$ " when assuming a symbol appears at times " 0 " and " T ".

16. (Original) A timing error detection method as set forth in claim 15, wherein said signal is a phase shift modulated signal.

17. (Original) A timing error detection method for detecting a timing error of symbols arranged at a predetermined symbol cycle T included in a signal, including the steps of:

- sampling at a frequency equal to double of a symbol rate;
- generating data at time " $T/4$ " by using said sampled data at time " 0 " and data at time " $T/2$ " when assuming a symbol appears at times " 0 " and " T ";
- generating data at time " $3T/4$ " by using said sampled data at time " $T/2$ " and data on time " T ";
- detecting an amplitude of said signal at the position from data at said time " $T/4$ " and time " $3T/4$ "; and
- detecting a direction and size of said timing error based on the large or small relationship and the difference of the amplitude at said time " $T/4$ " and the amplitude at said time " $3T/4$ ".

18. (Original) A timing error detection method as set forth in claim 17, wherein said signal is a signal subjected to phase shift modulation.

19. (Currently Amended) A demodulation ~~modulation~~ method including the steps of:

- sampling said signal at a frequency equal to double of twice a symbol rate;
- detecting an amplitude at said sampled position in said signal;
- detecting a direction and size of said timing error based on difference of said detected plurality of amplitudes;
- reproducing a symbol timing by performing interpolation processing on said signal based on the detected timing error;

performing carrier reproduction of the signal wherein said symbol timing is reproduced; and

decoding said symbol included in said carrier reproduced signal.

20. (Original) A demodulation method as set forth in claim 19, wherein said signal is a phase shift modulated signal.

21. (Original) A demodulation method, including the steps of:
sampling said signal including symbols arranged at a predetermined symbol cycle at a frequency equal to four times of a symbol rate;
detecting an amplitude at said sampled position in said signal;
detecting a direction and size of said timing error based on the large or small relationship and the difference of said detected amplitude at time " $T/4$ " and said detected amplitude at time " $3T/4$ " when assuming a symbol appears at times " 0 " and " T ";
reproducing a symbol timing by performing interpolation processing on said signal based on said detected timing error;
performing carrier reproduction of the signal wherein said symbol timing is reproduced; and
decoding said symbol included in said carrier reproduced signal.

22. (Original) A demodulation method as set forth in claim 21, wherein said signal is a phase shift modulated signal.

23. (Original) A demodulation method including the steps of:

sampling a signal including symbols arranged at a predetermined symbol cycle at a frequency equal to double of a symbol rate;

generating data at time " $T/4$ " by using said sampled data at time "0" and data at time " $T/2$ " when assuming a symbol appears at times "0" and " T ";

generating data at time " $3T/4$ " by using said sampled data at time " $T/2$ " and data at time " T ";

detecting an amplitude of said signal at the position from data at said time " $T/4$ " and data at time " $3T/4$ "; and

detecting a direction and amount of said timing error based on the large and small relationship and difference of the amplitude of said time " $T/4$ " and the amplitude at said time " $3T/4$ ";

reproducing the symbol timing by performing interpolation processing on said signal based on said detected timing error;

performing carrier reproduction of the signal wherein said symbol timing is reproduced; and

decoding said symbol included in said carrier reproduced signal.

24. (Original) A demodulation method as set forth in claim 23, wherein said signal is a signal subjected to phase shift modulation.